

Supplement of Biogeosciences, 15, 297–317, 2018  
<https://doi.org/10.5194/bg-15-297-2018-supplement>  
© Author(s) 2018. This work is distributed under  
the Creative Commons Attribution 3.0 License.



*Supplement of*

## **High organic inputs explain shallow and deep SOC storage in a long-term agroforestry system – combining experimental and modeling approaches**

**Rémi Cardinael et al.**

*Correspondence to:* Rémi Cardinael ([remi.cardinael@cirad.fr](mailto:remi.cardinael@cirad.fr))

The copyright of individual parts of the supplement might differ from the CC BY 3.0 License.

**Table S1.** Walnut tree fine root biomass (t C ha<sup>-1</sup>) as a function of depth and distance from the trees (m).

Soil depth (m)	Tree fine root biomass (t C ha <sup>-1</sup> )			
	Tree row		Alley	
	[0, 1] m	]1, 2.5] m	]2.5, 4.0] m	]4.0, 5.5] m
0.0-0.1	0.08 ± 0.01	0.08 ± 0.01	0.01 ± 0.00	0.00 ± 0.00
0.1-0.3	0.14 ± 0.02	0.24 ± 0.02	0.15 ± 0.02	0.05 ± 0.01
0.3-0.5	0.22 ± 0.02	0.16 ± 0.02	0.08 ± 0.01	0.05 ± 0.01
0.5-1.0	0.35 ± 0.04	0.14 ± 0.01	0.14 ± 0.01	0.08 ± 0.01
1.0-1.5	0.15 ± 0.02	0.10 ± 0.01	0.08 ± 0.01	0.08 ± 0.01
1.5-2.0	0.07 ± 0.01	0.13 ± 0.01	0.09 ± 0.01	0.07 ± 0.01
Total	1.01 ± 0.06	0.84 ± 0.04	0.55 ± 0.03	0.34 ± 0.02

Data modified from Cardinael *et al.*, (2015a). Errors represent standard errors.

**Table S2.** Covariance matrices  $P_b$  of optimized parameters corresponding to the three model variants: a) two pools model without priming effect, b) two pools model without priming effect, and c) three pools model without priming effect.

a)

	$a$	$D$	$A$	$h$
$a$	0.00005	0	0	0
$D$	0	0.000482	0	0
$A$	0	0	0.000427	0
$h$	0	0	0	0.17

b)

	$a$	$D$	$A$	$h$	$PE$
$a$	0.00005	0	0	0	0
$D$	0	0.0004505	0	0	0
$A$	0	0	0.0002135	0	0
$h$	0	0	0	0.065	0
$PE$	0	0	0	0	51.475

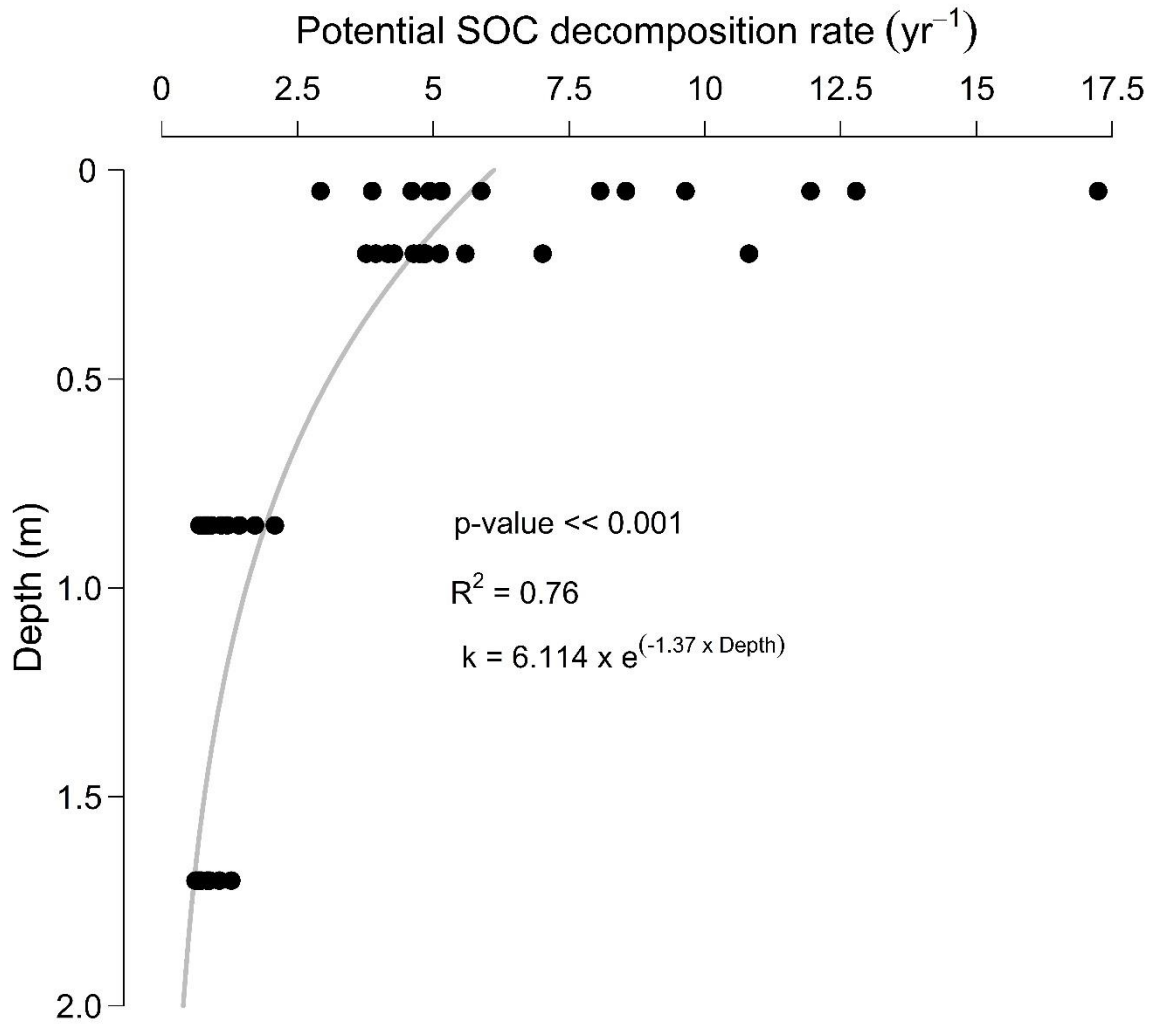
c)

	$a_1$	$a_2$	$D$	$A$	$h$	$f_1$	$f_2$
$a_1$	0.00005	0	0	0	0	0	0
$a_2$	0	0.00415	0	0	0	0	0
$D$	0	0	0.000482	0	0	0	0
$A$	0	0	0	0.000427	0	0	0
$h$	0	0	0	0	0.17	0	0
$f_1$	0	0	0	0	0	0.43	0
$f_2$	0	0	0	0	0	0	0.4

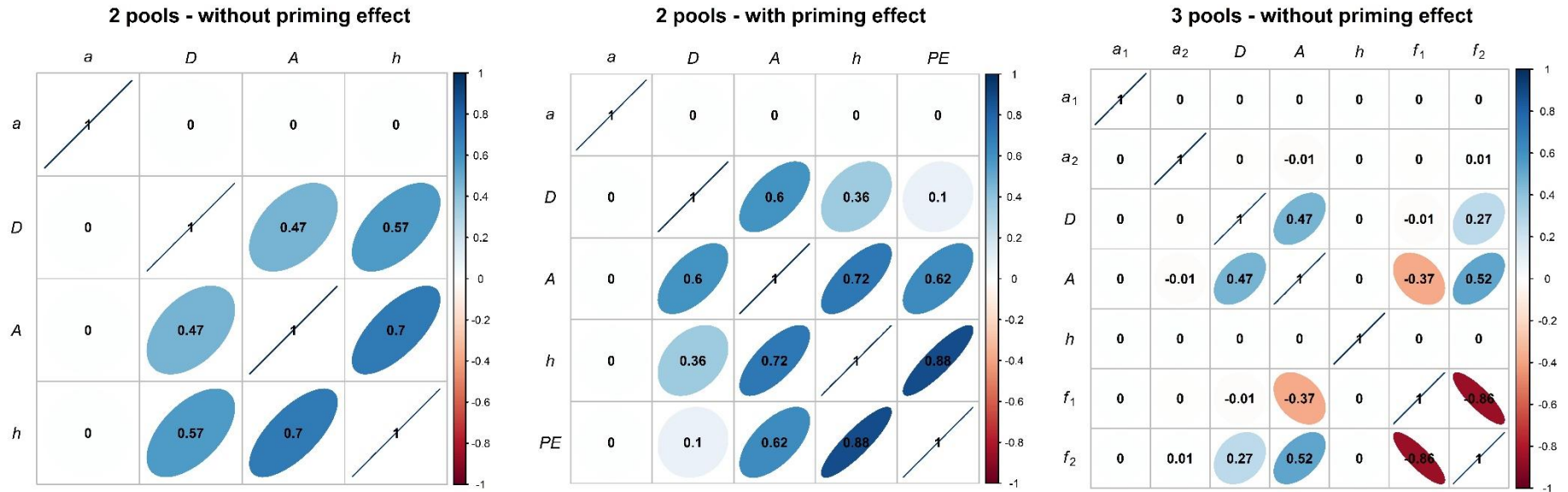
**Table S3.** Comparison of predictions with the two pools model with or without priming effect (*PE*), and with the three pools model.

		All soil profile			Topsoil (0-1 m)			Subsoil (1-2 m)		
		2 pools - without <i>PE</i>	2 pools - with <i>PE</i>	3 pools	2 pools - without <i>PE</i>	2 pools - with <i>PE</i>	3 pools	2 pools - without <i>PE</i>	2 pools - with <i>PE</i>	3 pools
Control	RMSE	1.05	0.41	1.04	1.20	0.43	1.25	0.87	0.42	0.79
	BIC	33.44	19.53	35.93	20.97	14.04	22.80	12.62	-0.79	14.10
	R <sup>2</sup>	0.34	0.90	0.35	0.42	0.86	0.39	0.00	0.97	0.04
	<i>a</i>	1.00	0.99	0.99	0.95	0.98	0.95	1.06	1.01	1.05
Tree row	RMSE	1.00	0.65	0.99	1.15	0.67	1.19	0.82	0.40	0.73
	BIC	37.13	25.51	39.54	19.53	14.10	21.13	9.36	8.29	10.74
	R <sup>2</sup>	0.93	0.97	0.93	0.92	0.96	0.92	0.42	0.55	0.42
	<i>a</i>	1.02	1.01	1.01	1.00	1.01	0.99	1.07	1.01	1.05
Alley	RMSE	1.07	0.95	1.10	1.42	1.29	1.47	0.55	0.37	0.51
	BIC	36.32	34.34	38.74	22.31	22.23	24.13	10.77	4.37	12.11
	R <sup>2</sup>	0.60	0.71	0.61	0.39	0.41	0.38	0.57	0.93	0.58
	<i>a</i>	0.97	0.96	0.96	0.94	0.96	0.94	1.02	0.97	1.00

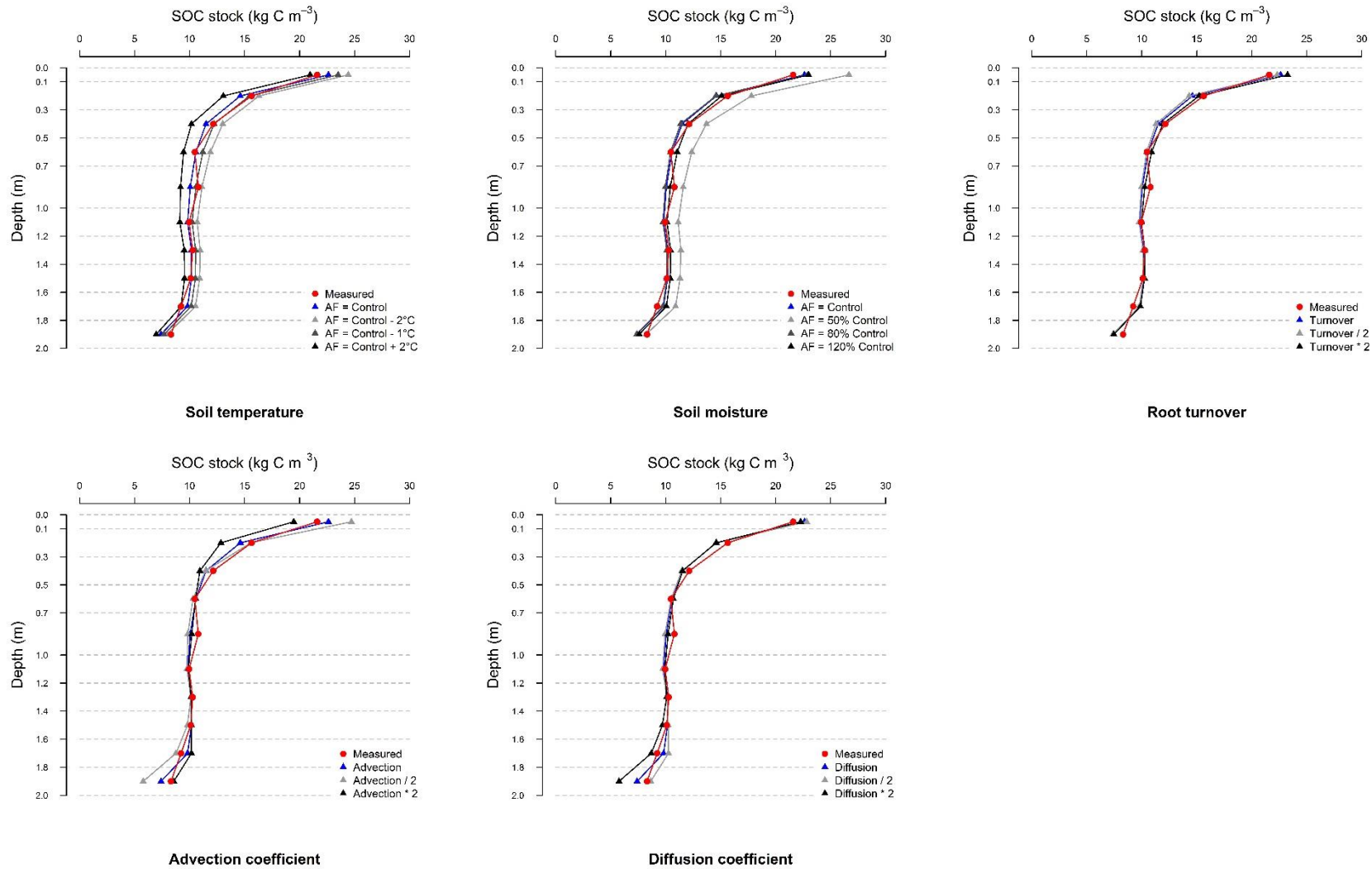
RMSE is the root mean square error (kg C m<sup>-3</sup>), BIC is the Bayesian information criterion, R<sup>2</sup> is the coefficient determination of the regression between modeled and observed SOC stocks, and *a* is the slope of this regression.



**Fig. S1.** Potential soil organic carbon (SOC) decomposition rate as a function of soil depth. For a given depth, four samples came from the control plot, the alley and the tree row.



**Fig. S2.** Correlation matrices of optimized parameters. For the two pools model,  $a$  is the coefficient from the Eq. (8) for the HSOC decomposition rate,  $h$  is the humification yield, and  $PE$  is the priming coefficient. For the tree pools model,  $a_1$  and  $a_2$  are the coefficients from the Eq. (8) for the HSOC1 and HSOC2 decomposition rates,  $f_1$  is the fraction of decomposed FOC entering the HSOC1 pool, and  $f_2$  is the fraction of decomposed HSOC1 entering the FOC pool. For both models,  $D$  is the diffusion coefficient ( $\text{cm}^2 \text{yr}^{-1}$ ) and  $A$  is the advection rate ( $\text{mm yr}^{-1}$ ).



**Fig. S3.** Sensitivity analysis of the model concerning soil temperature, soil moisture, tree root turnover, advection and diffusion coefficients. This analysis was performed using the two pools model with priming effect, using the tree row SOC stocks.